

Food-habits of water-birds of the Sundarban, 24 Parganas District, West Bengal, India—V¹

Lapwing, Sandpiper, Stint, Tern, Kingfisher

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(With three text-figures)
(Continued from Vol. 71(2):200)

Vanellus indicus indicus (Boddaert), The Red-wattled Lapwing

The Red-wattled Lapwing, *Vanellus indicus indicus* (Boddaert), is a common bird of the Sundarban area. It is generally met with singly or in pairs. In the reclaimed area it is found in cultivated fields especially after harvesting, on elevated bunds between such fields when these are inundated, as well as in fallow lands, edges of freshwater pools, tanks, etc. In forested area, it is sometimes seen on exposed mud-flats of tidal rivers and forest fringes, and sometimes near pools of water in the interior.

About the food-habits of the Red-wattled Lapwing, Jerdon (1864, p. 648) remarked that it feeds on various insects, shells, and worms. Mason & Lefroy (1912, p. 265) examined the food of nine examples at Pusa (Bihar) and stated: "Of 118 insects taken by 9 birds, 51 are injurious; 6 birds took injurious insects, 4 neutral and 4 injurious. One bird took a prawn, 1 shell and 2 vegetable matter". Baker (1929, p. 188) writes that its food consists of worms, grubs, insects of all kinds as well as freshwater mollusca, tiny crayfish, etc. Ali (1955, p. 92) found that it fed on insects, grubs, molluscs, etc.

On an examination of the stomach-contents of 69 specimens of the European Lapwing, *Vanellus, v. vanellus* (Linnaeus), Collinge (1927, p. 234) found that of the total food consumed during the year 89 per cent was animal food. Of this, injurious insects formed 60 per cent, neutral insects 4 per cent, slugs and snails 10 per cent, earthworms 10 per cent, and miscellaneous animal matter of a neutral nature 5 per cent.

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Only 11 per cent of the food was of vegetable nature, 6 per cent of which consisted of weed seeds and 5 per cent of miscellaneous vegetable matter. He thus concluded that 70 per cent of its food was of a beneficial nature and 30 per cent neutral.

The detailed analysis of the stomach-contents of 174 adult specimens of *Vanellus i. indicus* that I collected in the Sundarban is given in Table 18.

TABLE 18

ANALYSIS OF THE STOMACH-CONTENTS OF THE RED-WATTLED LAPWING

N = Number of specimens.

Weight = Total weight (in gramme) of examples of all species under a Class.

Length of fish = Its standard length.

Items of diet	No.	Wt.(g)	% (Wt.)	Remarks
Phylum Chordata				
Class Reptilia				
Order Squamata				
Suborder Serpentes				
Family COLUBRIDAE				
<i>Ptyas mucosus</i> (Linnaeus)	6			Common in cultivations. Parts of head, and body partly digested.
<i>Xenochrophis piscator</i> (Schneider)	2			Common in paddy-fields.
<i>Amphiesma stolata</i> (Linnaeus)	4			Common on tidal mud-flats, partly digested.
Total:	12	120	1.96	
Phylum Mollusca				
Class Gastropoda				
Order Archaeogastropoda				
Family NERITIDAE				
<i>Nerita</i> (<i>Odontostomia</i>) <i>lineata</i> (Dillwyn)	31			Complete shells.
Order Mesogastropoda				
Family VIVIPARIDAE				
<i>Viviparus bengalensis</i> (Lamarck)	56			Freshwater form. Mostly complete shells.
Family PILIDAE				
<i>Pila</i> sp.	10			-do-
<i>Littorina melanostoma</i> Gray	21			-do-
<i>Digonistoma</i> sp.	10			-do-
<i>Melanoides tuberculatus</i> (Müller)	85			-do-

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
<i>Melanoides</i> (<i>Plotia</i>) <i>scabra</i> (Müller)	17			-do-
Order Basommatophora				
Family LYMNAEIDAE				
<i>Lymnaea acuminata</i> (Lamarck)	40			-do-
Family PLANORBIDAE				
<i>Indoplanorbis exustus</i> (Deshayes)	22			Land-snail.
Shell fragments				Not identifiable.
Total:	292	1830	27.91	

Phylum Arthropoda**Class Insecta****Order Orthoptera****Family LOCUSTIDAE***Heiroglyphus banian*

Fabricius

81

Paddy-pest. In fragments.

Attractomorpha sp.

25

Pest of tobacco and vegetables.

Oxya sp.

31

Pest of paddy.

Chrotogonus sp.

82

Pest of cotton.

Acrotylus sp.

22

Pest of paddy nurseries.

Heteropternis sp.

19

-do-

Locusta danica Linnaeus

35

-do-

Pyrgomorpha sp.

6

-do-

Lefroya sp.

27

Coptotettix sp.

8

Family TETTIGIDAE*Acrydium* sp.

21

Scelimena sp.

16

Pest of cultivated plants.

Family GRYLLIDAE*Gryllus* sp.

35

Pest of roots of paddy, etc.

Liogryllus sp.

45

-do-

Acheta bimaculata

(De Geer)

30

-do-

Brachytrypes sp.

23

-do-

Family GRYLLOTALPIDAE*Gryllotalpa africana*

Beanvois

91

Mostly parts of body.

Gryllotalpa sp.

27

-do-

Orthopteran fragments

Not identifiable.

Order Dermaptera**Family LABIDURIDAE***Labidura* sp.**Family LABIIDAE***Labia minor* (Linnaeus)

17

Family CHELISOCHIDAE*Chelisoches morio* (Fab.)

3

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Family FORFICULIDAE				
<i>Forficula</i> sp.	12			
Forficulid claspers and fragmentary remains				Not identifiable.
Order Isoptera				
Family TERMITIDAE				
<i>Odontotermes</i> sp. ?	26			Partially digested. Therefore identification doubtful. Pest of Sugarcane and other Gramineae.
Order Odonata				
Suborder Zygoptera				
Family COENAGRIIDAE				
<i>Ischnura</i> sp. ? (Naiads)	40			Aquatic form.
<i>Coenagrion</i> sp. ? (Naiads)	32			-do-
Suborder Anisoptera				
Family AESCHNIDAE				
<i>Anax</i> sp. ? (Naiads)	20			-do-
<i>Aeschna</i> sp. (Naiads)	27			-do-
Family LIBELLULIDAE				
<i>Pantala</i> sp. (Naiads)	6			-do-
<i>Crocothemis</i> sp. (Naiads)	9			Aquatic form.
Odonata fragments				Not identifiable.
Order Hemiptera				
Family PENTATOMIDAE				
<i>Nezara viridula</i> Linnaeus	25			Pest of vegetables.
Family COREIDAE				
<i>Leptocoris</i> sp.	80			Pest of paddy-shoots.
Family PYRRHOCORIDAE				
<i>Dysdercus cingulatus</i> (Fabricius)	32			Pest of cotton, etc.
Family JASSIDAE				
<i>Nephotettix</i> sp.	100+			Rice leaf-hopper, pest.
Family GERRIDAE				
<i>Halobates</i> sp.	6			Aquatic form.
<i>Gerris</i> sp.	9			-do-
Family BELOSTOMATIDAE				
<i>Belostoma</i> sp.	7			Aquatic form, body in parts.
Family NEPIDAE				
<i>Ranatra</i> sp.	10			Aquatic form.
<i>Nepa</i> sp.	13			-do-
Family NOTONECTIDAE				
<i>Notonecta</i> sp. ?	21			-do-
Family CORIXIDAE				
<i>Corixa</i> sp.	8			
Order Lepidoptera				
Caterpillars				Partially digested. Not iden- tifiable.

Items of diet	No. Wt. (g) % (Wt.)	Remarks
Order Coleoptera		
Family CICINDELIDAE		
<i>Cicindela</i> sp.	6	
Family RUTELIDAE		
<i>Anomala elata</i> (Fabricius)	81	Pest of garden plants.
Family COCCINELLIDAE		
<i>Epilachna</i> sp.	27	Elytra only.
Family TENEBRIONIDAE		
<i>Opatrum</i> sp.	38	Pest of potato-tubers, etc.
Family MELOIDAE		
<i>Mylabris pustulata</i>		
Thunberg	26	Pest of earheads of paddy.
<i>Gnathospastoides rouxi</i>		
Castalenau	14	-do-
<i>Cylindrothorax ruficollis</i>		
(Fabricius)	14	-do-
<i>Cylindrothorax ? tenuicollis</i>	19	-do-
<i>Epicauta</i> sp.	28	-do-
Family CHRYSOMELIDAE		
<i>Podagria</i> sp.	6	Pest of <i>Hibiscus</i> .
<i>Sagra</i> sp. ?	3	Pest of <i>Dolichos lablab</i> .
<i>Oides affinis</i> Jacoby	7	Pest of paddy.
<i>Halitica cyanea</i> Weber	13	-do-
<i>Dicladispa armigera</i>		
(Olivier)	19	-do-
Family CURCULIONIDAE		
<i>Episomus</i> sp.	5	Pest of foliage of cultivated plants, especially pulses.
<i>Myllocerus</i> sp.	18	Pest of paddy.
<i>Atactogaster</i> sp.	10	Pest of cotton, vegetables, etc.
<i>Alcides</i> sp.	7	Pest of indigo, agathi, etc.
<i>Pempheres affinis</i>		
Fabricius	11	Pest of cotton.
Family SCARABAEIDAE		
<i>Heliocopriss bucephalus</i>		
(Fabricius)	16	
<i>Catharsius</i> sp.	12	
Family DYTISCIDAE		
<i>Dytiscus</i> sp.	9	Aquatic form.
Family GYRINIDAE		
<i>Gyrinus</i> sp.	8	-do-
Family HYDROPHILIDAE		
<i>Hydrocharis</i> sp. ?	7	-do-
<i>Berosus</i> sp.	6	-do-
Coleoptera larvae		Mutilated beyond identification.

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Order Hymenoptera				
Family FORMICIDAE				
<i>Dorylus orientalis</i>				
Walker	108			Pest of sugarcane, but I have found it on jute also.
<i>Solenopsis geminata</i>				
Fabricius	92			Pest of brinjal.
<i>Oecophylla smaragdina</i>				
Fabricius	62			Pest of mango and other trees.
<i>Camponotus compressus</i>				
Fabricius	188			Pest of various plants.
<i>Phidole</i> sp.	30			
Miscellaneous insect fragment				Not identifiable.
Total:	2017	3750	63.21	
Class Arachnida				
Order Araneae				
Family ARGYOPIDAE				
<i>Argyope</i> sp.	100+			
<i>Cyrtophora</i> sp. ?	100+			In bush.
<i>Leucage decorata</i> (Blackwall)	100+			Common in paddy and grass.
<i>Araneus</i> sp.	50+			Common, in bush and paddy.
<i>Cyclosa</i> sp.	10+			Common in bush.
Family TETRAGNATHIDAE				
<i>Ecuta javanica</i> Thorell	100+			Very common in paddy and grass. Invariably found in stomachs.
Family LYCOSIDAE				
<i>Lycosa</i> sp.	10+			Common in ground and in grass. Invariably present in stomachs.
<i>Hippasa</i> sp.	20+			-do-
Family OXYOPIDAE				
<i>Oxyopus</i> sp. ?	30+			
Miscellaneous spider fragments				
Total:	520+	345	5.63	
Phylum Annelida				
Class Chaetopoda				
Order Oligochaeta				
Family MEGASCOLECIDAE				
<i>Pheretima</i> sp.	10+			In bits. Invariably present in stomachs.

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
<i>Perionyx</i> sp.	10+			
<i>Eutyphoeus</i> sp. ?	5			Partially digested. Identification doubtful.
Family NAIDIDAE				
<i>Chaetogaster</i> sp. ?	6			Partially digested. Identification doubtful.
Family TUBIFICIDAE				
<i>Limnodrilus</i> sp.	10+			Tangled mass.
Miscellaneous Oligochaeta (bits)				Not identifiable.
Total:	41+	75	1.22	

The diet of this bird is solely of animal nature (Fig. 1). Of the total food consumed by 174 birds, 63.2 per cent represent insects, comprising 2017 examples belonging to 72 species. Of these 1683 examples representing 45 species are crop and vegetable pests; the rest are predators or neutral. The other items are mostly freshwater Mollusca (27.91%), spiders (5.63%), snakes (1.96%) and Oligochaeta (1.22%).

From the analysis it is seen that the Red-wattled Lapwing is a very useful bird, feeding on injurious insects that affect agriculture.

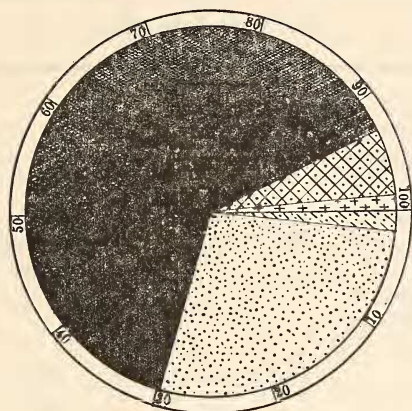
Tringa glareola Linnaeus, The Spotted Sandpiper

The Spotted Sandpiper, *Tringa glareola* Linnaeus, is a bird of the open marshes. It frequents freshwater bogs, inundated paddy-fields, flooded parts of the reclaimed area and tidal swampy forests. It moves in parties from one mul-flat to another pecking and probing for food on the exposed muddy banks during the ebb tides and at the edge of shallow water. It is a winter visitor.

Very little information is available about the food-habits of this bird. In India, Mason & Lefroy (1912, p. 268) analysed the stomach-contents of 24 examples and stated: "Of insects eaten by 24 birds, 9 are injurious, 3 beneficial and 43 neutral. Of 12 birds that contained insects, 4 took beneficial, 9 neutral and 6 injurious. Sixteen contained shells, 1 a prawn, 1 a shrimp, 3 a feather and 6 vegetable matter". Ali (1955, p. 94) stated about this and *Tringa ochropus* Linnaeus, that: "They run along on the squelchy mud picking up tit-bits or probe with their bills for food: insects, larvae, worms and molluscs". In Europe, Voous (1960, p. 97) found that the food consisted predominantly of small water and marsh insects; also worms and small molluscs outside the breeding season.

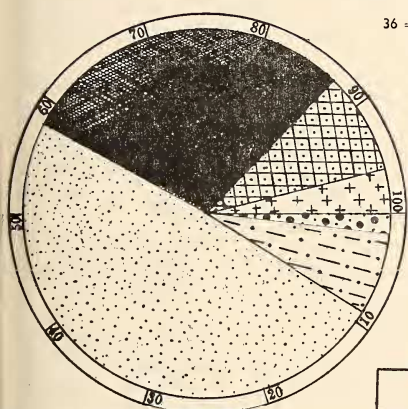
The detailed analysis of the stomach-contents of 38 adult specimens that I collected in the Sundarban is given in Table 19.

DIAGRAMMATIC REPRESENTATION OF THE PERCENTAGES OF
FOOD OF WATER BIRDS.

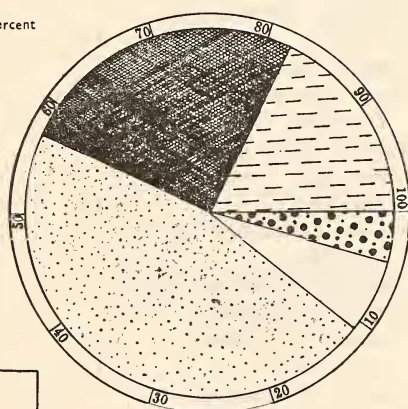


Vanellus indicus (Boddaert)

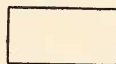
36 = 10 percent



Tringa glareola Linnaeus



Calidris minutus (Leisler)



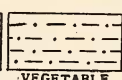
PISCES



MOLLUSCA



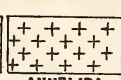
CRUSTACEA



VEGETABLE
MATTER



REPTILIA



ANNELIDA



AMPHIBIA



INSECTA



SAND AND
MISCELLANEOUS



ARACHNIDA

TABLE 19

ANALYSIS OF THE STOMACH-CONTENTS OF THE SPOTTED SANDPIPER

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Phylum Mollusca				
Class Gastropoda				
Order Archaeogastropoda				
Family NERITIDAE				
<i>Nerita (Odontostomia)</i>				
<i>lineata</i> (Dillwyn)	8			Minute shells. Brackish water form.
Order Mesogastropoda				
Family VIVIPARIDAE				
<i>Viviparus bengalensis</i> (Lamarck)	21			Minute shells. Freshwater form.
Family LITTORINIDAE				
<i>Littorina melanostoma</i> Gray	19			-do-
Family HYDROBIIDAE				
<i>Digoinostoma pulchella</i> (Benson)	6			-do-
Family MELANIIDAE				
<i>Melanoides tuberculatus</i> (Müller)	18			-do-
<i>Melanoides scabra</i> (Müller)	27			-do-
Order Basommatophora				
Family LYMNAEIDAE				
<i>Lymnaea acuminata</i> (Lamarck)	19			-do-
Family PLANORBIDAE				
<i>Indoplanorbis exustus</i> (Deshayes)	32			-do-
Family PATELLIDAE				
<i>Patella</i> sp. ?	15			Brackish water form.
Family PILIDAE				
<i>Pila</i> sp.	17			Freshwater form.
Family GALEODIDAE				
<i>Melongena</i> sp. ?	6			Brackish water form.
Class Bivalvia				
Family ARCIDAE				
<i>Arca</i> sp.	3			Brackish water form.
Miscellaneous molluscan fleshy pulp and shell-fragments				Not identifiable.
Total :	191	720	49.03	

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Phylum Arthropoda				
Class Insecta				
Order Orthoptera				
Family TETTIGIDAE				
<i>Acrydium</i> sp.	165			Pest of paddy nurseries.
Family LOCUSTIDAE				
<i>Chrotogonus</i> sp.	26			Pest of cotton, paddy, etc.
Order Odonata				
Suborder Anisoptera				
Naiads	25+			Mostly mutilated.
Suborder Zygoptera				
Family LIBELLULIDAE				
Naiads	40			-do-
Family COENAGRIIDAE				
Naiads	35			-do-
Order Hemiptera				
Family GERRIDAE				
<i>Halobates</i> sp.	60			Brackish water form.
<i>Gerris</i> sp. ?	78			-do-, partially digested.
Family GELASTOCORIDAE				
<i>Limnocoris</i> sp. ?	18+			Partially digested and mostly in fragments.
Family NEPIDAE				
<i>Ranatra</i> sp.	35			Freshwater form.
<i>Nepa</i> sp.	28			-do-
Family JASSIDAE				
Jassids	100+			Invariably present in stomachs.
Order Ephemerida				
Mayfly naiads	100+			Partially digested. Identification not possible.
Order Coleoptera				
Family GYRINIDAE				
<i>Gyrinus</i> sp.	16			
Family DYTISCIDAE				
<i>Canthydrus</i> sp.	6			Elytra and parts of body.
<i>Laccophilus</i> sp.	35			-do-
<i>Bidessus</i> sp.	40			-do-
<i>Hydratictus</i> sp.	3			-do-
<i>Eretes stictus</i> Linnaeus	100			
Order Diptera				
Family CULICIDAE				
Larvae & pupae	1000+			Partially digested.
Family CHIRONOMIDAE				
Larvae	100+			
Miscellaneous insect fragments				Not identifiable.
Total:	2010+	425	29.10	

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Class Arachnida				
Order Araneae				
Family ARGYOPIDAE				
<i>Tetragnatha</i> sp.	100+			Invariably present in stomachs.
Family OXYOPIDAE				
<i>Oxyopes</i> sp. ?	100+			
Family HERSILIDAE				
<i>Hersila</i> sp.	50+			
Miscellaneous spider fragments				Not identifiable.
Total:	250+	130	8.94	
Phylum Annelida				
Order Oligochaeta				
Family TUBIFICIDAE				
<i>Limnodrilus</i> sp.	100+			Tangled mass.
Family MAGASCOLECIDAE				
<i>Pheretima</i> sp.	6			
<i>Perionix</i> sp. ?	7			
Order Polychaeta				
Family SERPULIDAE				
<i>Mercierella</i> sp.	10+			Brackish water form. In bits.
<i>Ficopomatus</i> sp. ?	10+			-do-
Miscellaneous Annelida				Partially digested. Not identifiable.
Total:	133+	60	4.10	
Vegetable matter				
Fragments of aquatic plants and weed seeds:				Partially digested. Not identifiable.
Total:		100	6.84	
Sand		25	1.57	

The food of the Spotted Sandpiper is composed of 91.59 per cent of animal matter, 6.84 per cent of vegetable matter and 1.57 per cent of sand (Fig. 1) which is found mixed with the food. The animal matter is comprised of 49.08 per cent Mollusca in the form of minute shells and 29.10 per cent insects. Except three species of terrestrial grasshoppers, the other 20 species of insects found in the stomachs are immature aquatic forms representing naiads of dragon- and damselflies and, larvae and pupae of mosquitoes, chironomids, etc., and a few adult bugs and beetles. Spiders constitute 8.94 per cent of the diet, and Annelida which are represented by freshwater Oligochaeta and brackish water

Polychaeta, only 4.10 per cent. The vegetable constituents of the food is made up of fragments of aquatic plants and wild seeds to the extent of 6.84 per cent.

Since the bird destroys many harmful aquatic Diptera, such as larvae and pupae of mosquito and chironomid, it is certainly beneficial. The agriculturists are also benefitted by this bird as it devours some grasshoppers and leafhoppers.

***Calidris minutus* (Leisler), The Little Stint**

The Little Stint, *Calidris minutus* (Leisler), is a winter visitor to the Sundarban area from early December to the end of March. It is a social bird, often mixing with other stints and other waders, forming flocks, sometimes of considerable size. It inhabits freshwater marshes as well as the salt marshes of the estuaries, and prefers broad mud-flats of tidal rivers keeping close to the edge of the water. During the ebb tide, it searches in the silt for minute creatures and follows the water as it recedes. With the high tide it moves up to the bank and finally to the freshwater mud-flats in the interior.

Very little information is available about the food-habits of this bird. In India, Mason & Lefroy (1912, p. 270) examined the stomachs of three specimens at Pusa and found 15 neutral insects and shells. Whistler (1928, p. 364) mentions that it collects minute insects, Crustacea, worms, and the seeds of various aquatic plants. According to Baker (1929, p. 236) its food consists of insects, tiny worms, mollusca, beetles and sometimes seeds. Ali (1955, p. 96) mentions that it picks up tiny insects, crustaceans and molluscs. In Europe, Voous (1960, p. 101) found that its food consists of mainly small insects, including large quantities of mosquitoes and their larvae; and outside the breeding season large numbers of small crustaceans and snails are also taken.

The detailed analysis of the stomach-contents of 86 adult specimens that I collected in the Sundarban is given in Table 20.

TABLE 20

ANALYSIS OF THE STOMCH-CONTENTS OF THE LITTLE STINT

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Phylum Mollusca				
Class Gastropoda				
Order Mesogastropoda				
Family LITTORINIDAE				
<i>Littorina melanostoma</i>				
Gray	61			Some complete and some broken shells.

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Order Basommatophora				
Family LYMNAEIDAE				
<i>Lymnaea acuminata</i> (Lamarck)	32			Mostly complete shells.
Family PLANORBIDAE				
<i>Indoplanorbis exustus</i> (Deshayes)	19			-do-
Class Bivalva				
Family ARCIDAE				
<i>Arca</i> sp. ?	6			Part of opercula.
Miscellaneous shell fragments				Not identifiable.
Miscellaneous Mollusca pulp				Not identifiable.
Total:	118	425	46.18	
Phylum Arthropoda				
Class Crustacea				
Order Decapoda				
Family PALAEMONIDAE				
<i>Macrobrachium</i> sp.	27			Mostly in parts. Freshwater form.
<i>Macrobrachium rude</i> (Heller)	35			-do-
<i>Palaemon styliferus</i> (Milne-Edward)	29			-do-
Family PENAEIDAE				
<i>Metapenaeus</i> sp.	18			Brackish water form.
Family GRAPSIDAE				
<i>Varuna litterata</i> (Fabricius)	33+			Brackish water form, partially digested.
Miscellaneous crustacean fragments				Not identifiable.
Total:	142	172	17.70	
Class Insecta				
Order Orthoptera				
Family TETTIGIDAE				
<i>Acrydium</i> sp.	9			Semi-aquatic and ground- hopper.
<i>Scelimena</i> sp.	13			-do-
<i>Loxilobus</i> sp.	7			-do-
Order Dermaptera				
Family LABIIDAE				
<i>Labia</i> sp.	3			
Miscellaneous earwigs				Claspers and parts of body.

Items of diet	No.	Wt.(g)	% (Wt.)	Remarks
Order Ephemera				
Family EPHEMERIDAE				
Naiads	5			Partly digested.
Order Odonata				
Suborder Zygoptera				
Family COENAGRIIDAE				
Naiads	8			-do-
Suborder Anisoptera				
Family AESCHNIDAE				
<i>Aeschna</i> sp. ? (naiads)	2			-do-
Miscellaneous dragon- & damselflies larvae				Not identifiable.
Order Hemiptera				
Family GERRIDAE				
<i>Gerris</i> sp.	17			Aquatic form. Partially digested.
<i>Halobates</i> sp. ?	9			
Family NAUCORIDAE				
<i>Laccocoris</i> sp.	6			-do-
<i>Limnocoris</i> sp.	4			-do-
Family NEPIDAE				
<i>Ranatra</i> sp.	3			Aquatic form.
Order Coleoptera				
Family DYTISCIDAE				
<i>Laccophilus</i> sp.				
<i>Eretes stictus</i>				
Linnaeus	17			Aquatic form.
Family GYRINIDAE				
<i>Dineutes</i> sp.	4			Aquatic form. Elytra and parts of body.
<i>Gyrinus</i> sp. ?	7+			Mostly mutilated.
Family JASSIDAE	100+			Digested beyond identification.
Order Diptera				
Family CULICIDAE				
Larvae	100+			In tangled mass. Partially digested.
Miscellaneous insect fragments				Not identifiable.
Total:	314+	230	25	
Vegetable matter:				
<i>Panicum</i> sp. ? (seeds)				
Grass and leaves (bits)				
Total:		55	6	
Sand	Total:	40	4.35	

The food of the Little Stint consists of 89 per cent of animal matter and 6 per cent of vegetable matter, the balance (4.35%) being made up by sand (Fig. 1). The animal matter comprises of minute molluscs (46.18%) which are generally taken complete with shells; arthropods represented by freshwater and brackish water crustaceans (17.70%), and insects (25%) of mostly aquatic and a few terrestrial species. The crustaceans are of commercial value.

Since the bird consumes some crustaceans of commercial value, it does not appear to be completely a harmless bird, but its adverse effect on fishery is too little to warrant branding it as a injurious bird.

***Chlidonias hybrida indica* (Stephens), The Indian Whiskered Tern**

The Whiskered Tern, *Chlidonias hybrida indica* (Stephens) is a common bird of the freshwater and brackish water marshes of the Sundarban area. It frequents open water bordered by dense vegetation and reedbeds. It is a winter visitor and is commonly seen in parties consisting of half a dozen to a dozen individuals, circling over drying pools and *gheries* diving from time to time to collect food.

About the food-habits of the Indian Whiskered Tern, Jerdon (1864, p. 837) stated: "This tern is exceedingly abundant in India, frequenting marshes, tanks and rivers, usually preying on aquatic food, not unfrequently hunting over fields, beds of reeds, and marshy ground, where it captures grasshoppers, caterpillars and other insects". Whistler (1928, p. 373) recorded: "Dragonflies and their larvae appear to be their staple food, but water beetles and other aquatic insects are freely taken". Baker (1929, p. 112) writes that it lives principally on water insects and larvae, dragonflies, grasshoppers, etc., and also on fish and tadpoles. Ali (1955, p. 91) states that the food comprises of tiny fishes, tadpoles, crabs, grasshoppers and other insects. The allied European subspecies *C. h. hybrida* (Pallas) takes all sorts of small animals living on or near the water's surface, such as small fish, frogs, dragonflies, and other aquatic and marsh insects (Voous, 1960, p. 131).

The detailed analysis of the stomach-contents of 13 adult specimens of the Indian subspecies that I collected in the Sundarban is given in Table 21.

TABLE 21

ANALYSIS OF THE STOMACH-CONTENTS OF THE INDIAN WHISKERED TERN

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Phylum Chordata				
Class Amphibia				
Order Anura				
Family RANIDAE				
Tadpoles	10			Partially digested beyond identification.

Items of diet	No.	Wt.(g)	% (Wt.)	Remarks
<i>Rana limnocharis</i>				
Boie	2			Subadult.
<i>Rana tigrina</i> Daudin ?	1			Subadult.
Miscellaneous frogs				Mutilated beyond identification.
Total:	13	20	6.66	
Series Pisces				
Class Teleostomi				
Order Cypriniformes				
Family CYPRINIDAE				
<i>Chela</i> sp.	7			Partly digested.
<i>Puntius</i> sp.	14			Length 30-40 mm. Invariably present in stomachs.
Family CLARIIDAE				
<i>Clarius batrachus</i> (Linnaeus)	1			Length 50 mm.
Family BAGRIDAE				
<i>Mystus</i> sp.	8			Length 30-40 mm. Partially digested.
Order Perciformes				
Family ANABANTIDAE				
<i>Anabas testudineus</i> (Bloch)	2			Length 40-50 mm.
Miscellaneous fish remains				Not identifiable.
Total:	32	50	20	
Phylum Arthropoda				
Class Crustacea				
Order Decapoda				
Family PALAEMONIDAE				
<i>Macrobrachium</i> sp.	19			Invariably present in stomachs.
<i>Palaemon styliferus</i> (Milne-Edward)	6			
Family ATYIDAE				
<i>Caridina gracilipes</i> de Man	10+			Fragmentary remains. Partially digested.
Miscellaneous crustacean fragments				Not identifiable.
Total:	35	50	20	

Items of diet	No.	Wt.(g)	% (Wt.)	Remarks
Class Insecta				
Order Orthoptera				
Family LOCUSTIDAE				
<i>Hieroglyphus banian</i>				
Fabricius	6			Pest of paddy.
<i>Locusta migratoria</i>				
(Reiche & Fairmaire)	4			Pest of paddy.
<i>Attractomorpha</i> sp.	5			Pest of paddy, vegetables, etc.
Family GRYLLIDAE				
<i>Brachytupes</i> sp.	3			Pest of roots of crop, etc.
Miscellaneous orthopteran fragments				Not identifiable.
Order Odonata				
Suborder Zygoptera				
Family COENAGRIIDAE				
Naiads	25			Partially digested beyond identification.
<i>Ceriagrion</i> sp.	4			Wings and parts of body.
<i>Ischnura</i> sp.	8			-do-
Suborder Anisoptera				
Family LIBELLULIDAE				
<i>Crocothemis</i> sp.	16			-do-
<i>Brachythemis</i> sp.	13			-do-
Order Hemiptera				
Family NEPIDAE				
<i>Nepa</i> sp.	8			Aquatic form.
Family BELOSTOMATIDAE				
<i>Belostoma</i> sp.	4			Elytra and fragments of body.
Order Coleoptera				
Family DYTISCIDAE				
<i>Laccophilus</i> sp.	9			Aquatic form.
Family GYRINIDAE				
<i>Gyrinus</i> sp.				
Miscellaneous coleopteran fragments				
Order Hymenoptera				
Family VESPIDAE				
<i>Vespa orientalis</i>				
Linnaeus	7			Mutilated body.
Miscellaneous insect fragments				Not identifiable.
Total:	87	170	53.33	

The Whiskered Tern subsists solely on animal food (Fig. 2), of which 6.66 per cent consists of tadpoles and frogs; 20 per cent of small fishes (30-70 mm standard length) of commercial value; 53.33 per cent

of insects (mostly aquatic, some immature dragon- and damselflies, a few adult bugs and beetles), and some terrestrial grasshoppers which are pests of cultivated plants; the crustaceans taken are in small proportion (20%) and are of commercial value.

From the economic point of view the bird does not appear to be beneficial since 40 per cent of food consists of fishes and crustaceans of commercial value. This is far from compensated by the few insect pests of agriculture that it destroys.

Ceryle rudis leucomelanura Reichenbach, The Pied Kingfisher

The Pied Kingfisher, *Ceryle rudis leucomelanura* Reichenbach, is a common bird of the tidal rivers and creeks, inland pools and inundated fields of the Sundarban. It has not been observed in the interior of forests, and it appears to be more common in the creeks and rivers than in inland waters.

Regarding the food of the Pied Kingfisher, both Jerdon (1863, p. 234) and Blanford (1895, p. 120) state that it feeds entirely on fish. Mason & Lefroy (1912, p. 167) analysed five stomachs and concluded that the birds fed entirely on fish. Whistler (1927, p. 232) stated: "Its diet consists entirely of small fish". Baker (1927, p. 248) mentioned: "Its food is entirely aquatic and principally small fishes, though it will also eat water-insects, tadpoles, tiny prawns or very small frogs". Ali (1955, p. 56) lists fish, tadpoles, frogs and aquatic insects as its food.

The detailed analysis of the stomach-contents of 299 adult specimens that I collected in the Sundarban is given in Table 22.

TABLE 22

ANALYSIS OF THE STOMACH-CONTENTS OF THE PIED KINGFISHER

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Phylum Chordata				
Series Pisces				
Class Teleostomi				
Order Cypriniformes				
Family CYPRINIDAE				
<i>Puntius</i> sp.	122			Freshwater form.
<i>Chela</i> sp.	29			Quite common in stomachs.
Family BAGRIDAE				
<i>Mystus</i> sp.	187			-do-
Order Scopeliformes				
<i>Harpodon nehereus</i>				
(Hamilton)	18			Brackish water form.
Order Cyprinodontiformes				
Family CYPRINODONTIDAE				
<i>Oryzias melastigma</i>				
(McClelland)	51			

Items of diet	No.	Wt.(g)	% (Wt.)	Remarks
Order Mugiliformes				
Family MUGILIDAE				
<i>Rhinomugil corsula</i> (Hamilton)	17			Length 35-45 mm.
<i>Mugil parsia</i> (Hamilton)	117			Brackish water form.
<i>Mugil tade</i> Forskal	6			Quite common in stomachs.
Order Polynemiformes				
Family POLYNEMIDAE				
<i>Polynemus paradiseus</i> Linnaeus	12			Length 30-60 mm.
Order Perciformes				
Family AMBASSIDAE				
<i>Ambassis</i> sp.	126			Freshwater form. Quite common in stomachs.
Family SCIAENIDAE				
<i>Pseudosciaena</i> sp.	10			
<i>Johnius</i> sp.	18			Length 45-55 mm. Brackish water form.
<i>Pama</i> sp.	6			-do-
Miscellaneous fish remains				Not identifiable.
Total:	719	2246	57.0	

Phylum Arthropoda**Class Crustacea****Order Decapoda****Family PALAEMONIDAE**

Macrobrachium lamerrei
(Milne-Edward)

81

Freshwater form. Quite common in stomachs.

Macrobrachium rude
(Heller)

17

Palaemon styliferus
(Milne-Edward)

12

Freshwater form.

Family ATYIDAE

Cardina gracilipes
de Man

62—

Partly digested.

Family PENAEIDAE

Metapenaeus brevicornis
(Milne-Edward)

109

Brackish water form. Quite common in stomachs.

Metapenaeus monoceros
Fabricius

61

-do-

Miscellaneous crustacean fragments

-

Not identifiable.

Total: 342 680 17.0

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Class Insecta				
Order Hemiptera				-
Family BELOSTOMATIDAE				
<i>Belostoma</i> sp.	69+			Freshwater form. Quite common in stomachs.
Family NOTONECTIDAE				
<i>Notonecta</i> sp.	32			Some in fragments.
Family CORIXIDAE				
<i>Corixa</i> sp.	63			
Order Coleoptera				
Family DYTISCIDAE				
<i>Laccophilus</i> sp.	28			Freshwater form.
<i>Bidessus</i> sp.	26			
<i>Eretes stictus</i> Linnaeus	75			-do-. Quite common in stomachs.
Family GYRINIDAE				
<i>Gyrinus</i> sp.	50			Freshwater form. Quite common in stomachs.
Miscellaneous insect fragments				Not identifiable.
Total:	343	1040	26.0	

The bird consumes wholly animal food comprising of 57 per cent fishes, 26 per cent aquatic insects and 17 per cent crustaceans (Fig. 2). The fishes and crustaceans, which form the major bulk are of commercial value. Most of the fishes are brackish water forms but a few are freshwater species. These fishes measure 30-60 mm in standard length. The crustaceans on the other hand are mostly freshwater species with a few brackish water forms.

Since as much 74 per cent of its diet consists of fishes and crustaceans of commercial value, it may be regarded as a bird destructive to pisciculture.

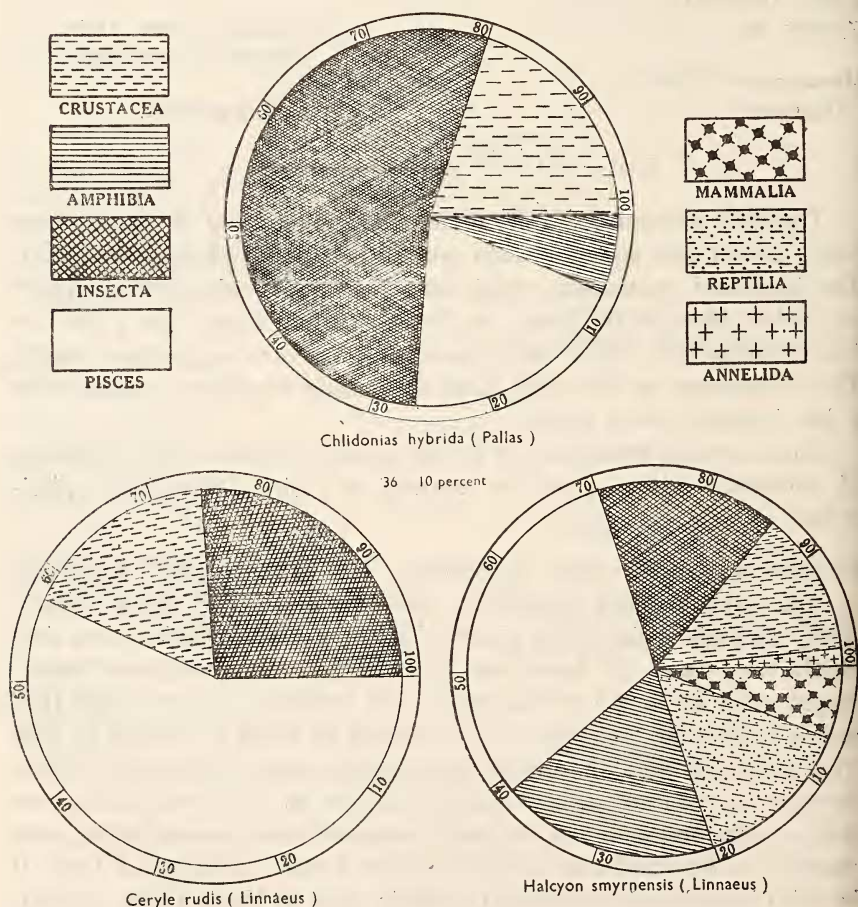
Halcyon smyrnensis fusca (Boddaert), The Whitebreasted Kingfisher

The Whitebreasted Kingfisher, *Halcyon smyrnensis fusca* (Boddaert), is mainly a bird of the plains of India. In the Sundarban area during the wet season, it is found near about freshwater ponds, jheels, water-logged areas along the embankments and inundated or dry fields. It is rare in tidal creeks and rivers. It dives from its perch to capture its prey from either the edge of tanks or very shallow water. During dry season, however, it does not depend upon water for its food, and it disperses over a wide area perching on poles, horizontal wires across fields, trees standing in dry land and even enters thin forests in search of food. It has also been found sometimes to remain close to Cattle Egrets or graz-

ing cattle by flying from perch to perch, and insects disturbed them are picked up by it.

The food of this kingfisher is of varied nature. Jerdon (1862, p. 225) mentions that it is composed of land-crabs, mouse, lizard, grasshoppers and other insects; and near water, fish, tadpoles and water-insects. Blanford (1895, p. 132) states that though it occasionally but rarely catches fish by plunging after them, it lives chiefly on insects and small lizards and sometimes on mice and land-crabs. Mason & Lefroy (1912, p. 168) observed the bird taking grasshoppers at Pusa and Chindwara, and once eating a lizard at Pusa. Baker (1927, p. 270) wrote: "Its principal article of diet are undoubtedly grasshoppers and locusts, but it will eat almost anything not too large to swallow. Frogs, small lizards, worms, etc., are all thankfully taken and eaten; I have seen it taking cicadae from the

DIAGRAMMATIC REPRESENTATION OF THE PERCENTAGES OF
FOOD OF WATER BIRDS.



trunk of trees, whilst prawns, small crabs, etc., are taken in preference to fishes when it haunts streams". Whistler (1928, p. 235) stated: "This very typical kingfisher is mainly a land-bird and feeds largely on insects, lizards, frogs and such small fry, which it captures after the manner of a Roller, flying down to them on the ground from an elevated perch. It is said very occasionally both to plunge into water after fish and to take insects on the wing". Ali (1955, p. 57) mentions fish, tadpoles, lizards, grasshoppers and other insects, young birds and mice as its food.

Gibson Hill (1951) mentions that the principal constituent of the diet of the allied form, *H. s. prepulchra* Madarasz, in Singapore is undoubtedly insects, mostly grasshoppers and other Orthoptera. Often these are taken in the larval stage. It also eats a number of lizards, chiefly skinks. He examined eight stomachs which yielded the remains of three skinks, *Mabuya* sp., feathers and head of *Munia* sp., some 15 grasshoppers and mantids, four beetles, three bees, four large black ants, a small scorpion, *Isometrus maculatus*, and two centipedes, *Scolopendra subspinipes*. There was no trace of fish or crustacea.

The detailed analysis of the stomach-contents of 192 adult specimens that I collected in the Sundarban is given in Table 23.

TABLE 23

ANALYSIS OF THE STOMACH-CONTENTS OF THE WHITEBREASTED KINGFISHER

Items of diet	No.	Wt. (g)	% (Wt.)	Remarks
Phylum Chordata				
Class Mammalia				
Order Rodentia				
Family MURIDAE				
<i>Mus</i> sp.	12			Partially digested.
Family SCIURIDAE				
<i>Funambulus pennanti</i>				
Wroughton	7			Mutilated, young.
Total:	19	180	6.92	
Class Reptilia				
Order Lacertilia				
Family AGAMIDAE				
<i>Calotes</i> sp.	31			
Order Squamata				
Suborder Serpentes				
Family COLUBRIDAE				
<i>Ptyas mucosus</i>				
(Linnaeus)	11			

Items of diet	No.	Wt.(g)	% (Wt.)	Remarks
<i>Natrix</i> sp.	13			
Miscellaneous Reptilia (mutilated)				Mostly small lizards. Not identifiable.
Total:	55	360	13.84	
Class Amphibia				
Order Anura				
Family RANIDAE				
<i>Rana</i> sp. (tadpoles)	200+			Partially digested.
<i>Rana</i> ? <i>limnocharis</i> Wiegmann	21			Some mutilated.
<i>Rana tigrina</i> Daudin	6			
Family BUFONIDAE				
<i>Bufo melanostictus</i> Schneider	9			
Miscellaneous tadpoles				Digested beyond identification.
Total:	236+	496	19.07	
Series Pisces				
Class Teleostomi				
Family CYPRINIDAE				
<i>Puntius</i> sp.	60			Length 10-20 mm. Freshwater form.
Family BAGRIDAE				
<i>Mystus</i> sp.	82			Length 10-25 mm. Partly digested.
Order Perciformes				
Family ANABANTIDAE				
<i>Anabas testudineus</i> (Bloch)	42			Length 20-40 mm.
Total:	184	812	31.23	
Phylum Arthropoda				
Class Crustacea				
Order Decapoda				
Family PALAEMONIDAE				
<i>Macrobrachium</i> sp.	71			Freshwater form.
<i>Macrobrachium rude</i> (Heller)	26			-do-
<i>Palaemon styliferus</i> Milne-Edward	18			-do-
Family POTAMONIDAE				
<i>Paratelphusa</i> sp.	9			Parts of body.
Miscellaneous Crustacea fragments				Not identifiable.
Total:	124	292	11.23	

Items of diet	No.	Wt.(g)	% (Wt.)	Remarks
Class Insecta				
Order Orthoptera				
Family LOCUSTIDAE				
<i>Hieroglyphus</i> sp.	21			Paddy pest.
<i>Attractomorpha</i> sp.	15			Pest of tobacco and vegetables.
Family TETTIGIDAE				
<i>Acrydium</i> sp.	22			
Family GRYLLIDAE				
<i>Gryllus</i> sp.	5			Pest of paddy-roots.
<i>Achaeta</i> sp.	9			-do-
<i>Brachytrypes</i> sp.	19			-do-
Family GRYLLOTALPIDAE				
<i>Gryllotalpa</i> sp.	36			-do-
Miscellaneous orthopteran fragments				Not identifiable.
Order Dermaptera				
Family LABIDURIDAE				
<i>Labidura</i> sp.	6			
Family CHELISOCHIDAE				
<i>Chelisoches</i> sp.	4			
Forficulid claspers and fragmentary remains				Not identifiable.
Order Hemiptera				
Family BELOSTOMATIDAE				
<i>Belostoma</i> sp.	6			Aquatic form.
Family PYRRHOCORIDAE				
<i>Dysdercus cingulatus</i> Fabricius	4			Pest of cotton and vegetables.
Order Lepidoptera				
Miscellaneous larvae				Partially digested beyond identification.
Order Coleoptera				
Family DYTISCIDAE				
<i>Eretes stictus</i> Linnaeus	12			Aquatic form.
Family DYNASTIDAE				
<i>Oryctes rhinoceros</i> Linnaeus	3			Pest of coconut palm.
<i>Phyllognathus dionysius</i> (Fabricius)	11			Pest of paddy-ears.
Family RUTILIDAE				
<i>Anomala elata</i> (Fabricius)	16			Underground stem-and root-feeder of cultivated plants.
Family MELOIDAE				
<i>Epicauta</i> sp.	27			Pest of paddy-ears.
Family CICINDELIDAE				
<i>Cicindela</i> sp.	9			
Miscellaneous Coleoptera (elytra)				Not identifiable.

Items of diet	No.	Wt.(g)	% (Wt.)	Remarks
Order Hymenoptera				
Family FORMICIDAE				
<i>Dorylus</i> sp.	4			Pest of sugarcane, jute, etc.
<i>Solenopsis</i> sp.	6			Pest of brinjal.
Miscellaneous insect fragments				Not identifiable.
Total:	235	420	16.15	

Phylum Annelida

Class Chaetopoda

Order Oligochaeta

Family MEGASCOLECIDAE

Pheritima sp. 13+

Partially digested.

Miscellaneous earthworms
(bits)

Not identifiable.

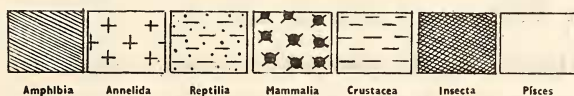
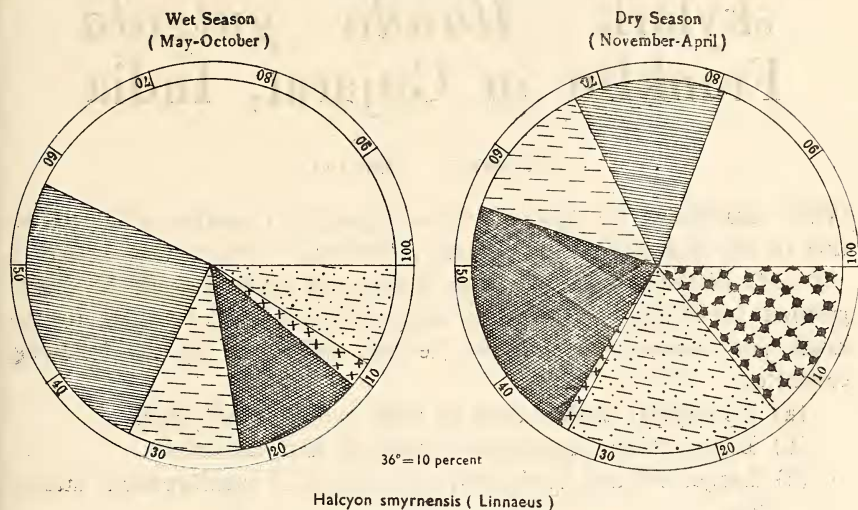
Total:	13+	40	1.53
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The entire food of the Whitebreasted Kingfisher consists of animals. It is composed of 31.23 per cent of fishes which are small fry of commercial freshwater species, 19.07 per cent of Amphibia (tadpoles, frogs and toads), 13.84 per cent of reptiles (snakes and lizards), 6.92 per cent of mammals (mouse and squirrel), 11.23 per cent of Crustacea of commercial value; 16.15 per cent of Insecta, and 1.53 per cent of Annelida represented by moist soil earthworms (Fig. 2). The insects taken by the bird have been found to be mostly pests of crops and vegetable. Out of the 235 examples representing 20 species recorded from the stomachs, 198 examples representing 14 species have been found to be injurious to crops, two predators and four neutral.

The food of this bird during the rainy (wet) season varies to some extent from that of dry season. During the wet season (May to October) when the water level is much higher and the whole area is largely inundated, the birds live more on aquatic animals, such as tadpoles, fishes, shrimps, prawns, aquatic insects and annelids; while during the drier months from November to April it consumes more of land organisms.

Out of the 192 specimens of the bird studies, 109 were collected during the wet period and 83 during the dry season. Analysis of their stomach-contents reveals the following seasonal variation (Fig. 3):

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Animal groups:

Wet season:
(food percentage)

Dry season:
(food percentage)

Mammalia	—	14.10
Reptilia	8.84	18.74
Amphibia	25.00	13.14
Pisces	42.96	19.40
Crustacea	10.00	12.46
Insecta		
Terrestrial	3.00	16.00
Aquatic	8.14	5.16
	<u>11.14</u>	<u>21.16</u>
Annelida	<u>2.06</u>	<u>1.00</u>

From the data presented above it may be generalised that during the wet season this bird is not beneficial since it consumes fish fry and shrimps of commercial value which constitute more than half (52.96%) the total bulk of its food. On the other hand, in the dry season it does immense service to the agriculturists by consuming insect and rodent pests of agriculture, which together form 35.26 per cent of its diet.

(to be continued)